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REPORT BY THE

Comptroller General

OF THE UNITED STATES

COMPLETED²⁷

Clearer EPA Superfund Program Policies Should Improve Cleanup Efforts

The Environmental Protection Agency (EPA) responds to the release or threatened release of hazardous substances into the environment through its Superfund removal and remedial programs. This report focuses on the Superfund removal program at the nation's worst hazardous waste sites. EPA limits removal actions to preventing or mitigating immediate and significant risk to humans or the environment so that an inordinate share of the Superfund budget would not be used on less significant sites. This policy, however, inhibits EPA in the permanent, long-term cleanup of waste sites. It has resulted in the worst hazardous waste sites receiving only stopgap cleanups, leaving hazardous substances on the surface and requiring repeated stopgap actions at additional cost.

EPA has proposed policy changes that would allow more thorough surface cleanup at sites. GAO agrees with this change but recommends that EPA include in its policy revision a requirement that removal actions eliminate surface hazardous substances to the extent possible to reduce recurring threats, avoid repeated actions, minimize Superfund expenditures, and contribute to the permanent remedy of hazardous waste sites.



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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

B-217374

The Eonorable James J. Florio
Chairman, Subcommittee on Commerce,
Transportation, and Tourism
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

As requested in your July 5, 1984, letter and in subsequent discussions with your office, this report examines the types of removal actions taken at hazardous waste sites, their accomplishments and contributions to long-term cleanup goals, and whether existing legislation allows for more comprehensive cleanup of contamination by the removal program.

Unless you publicly release its contents earlier, we will make this report available to other interested parties 7 days after the issue date. At that time, copies of the report will be sent to appropriate congressional committees; the Administrator, Environmental Protection Agency; the Director, Office of Management and Budget; and other interested parties.

Sincerely yours,

A handwritten signature in cursive script, reading "Charles A. Bowsher", is written over the typed name.

Comptroller General
of the United States

D I G E S T

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly known as Superfund, authorizes the federal government to clean up hazardous substances from the environment. The act provides for a \$1.6 billion fund to be accumulated over a 5-year period from taxes on petroleum and certain chemicals and from federal appropriations.¹ The Environmental Protection Agency (EPA) manages the fund to clean up spilled toxic wastes and hazardous waste sites and takes enforcement actions to recover from responsible parties the funds it expends during site cleanup. Superfund's taxing authority expires at the end of fiscal year 1985. Because of the increased awareness over the size of the cleanup problem, the Congress is considering substantial increases to the size of the fund.

EPA has identified about 18,000 hazardous waste sites, of which 538 have been designated as the worst sites (called priority sites); an additional 248 sites have been proposed for inclusion as priority sites as of October 1984.

EPA's regulations provide for three types of Superfund cleanup actions: immediate removals to respond to immediate and significant threats, but not necessarily final solutions (such as stopping major leaks of waste tanks and ponds); planned removals to provide planned responses for cleanup to imminent and substantial dangers when time permits; and remedial actions to achieve permanent, cost-effective remedies, although they may not be prompt. Immediate removals are used anywhere immediate and significant risks appear.

¹Most of the Superfund, about 87%, comes from the earmarked tax receipts on petroleum and certain other chemicals. As of December 1984, EPA received \$1.55 billion in appropriations and reported obligations of \$916 million and disbursements of \$521 million.

Remedial actions are used only at sites that are designated as priority sites. Meant as final remedies, these are usually slow to be achieved--a lag time during which potential hazardous waste conditions can worsen, requiring repeated prompt actions. Planned removals, not extensively used, generally are reserved for non-priority sites. (See pp. 2 to 5.)

Concerned that EPA's immediate removal actions may constitute only temporary solutions to hazards and that such actions may not be coordinated with long-term site cleanup goals of subsequent remedial actions at priority sites, the Chairman, Subcommittee on Commerce, Transportation, and Tourism, House Committee on Energy and Commerce, asked GAO to review EPA's removal program activities. Specifically, GAO was asked to determine the types of immediate removal actions taken, their accomplishments and contributions to long-term cleanup goals, and whether existing legislation allows more comprehensive cleanup of hazardous substances through immediate removals. (See pp. 5 and 6.)

GAO found that from December 1980 (when Superfund became law) to February 1984 (when GAO completed its site identification work), EPA finished immediate removal actions at 165 hazardous waste sites. Even though EPA has finished additional immediate removal actions since GAO completed its work, GAO's message remains valid because EPA has not yet revised its immediate removal policy.

GAO found that the types and extent of immediate removal actions taken varied in terms of cost, the kind of response required, and the degree of contribution to long-term site cleanup. Actions ranged from complete removal of hazardous substances from sites not on the priority list, to containing or stabilizing the hazards at priority sites for future remedial action. Generally, subsurface contamination problems (such as groundwater contamination) are addressed under the remedial program because their solution requires extensive study. Surface hazards, though, are often amenable to complete cleanup because they are at or near the surface rather than below it. Current EPA policy on immediate removals at priority sites has often led to the containment or stabilization of the surface

waste problems at the site, such as sealing leaking containers. Since this is not a final solution, however, the result is persistent threats to the public and the environment and increased overall cleanup costs.

EPA has proposed changes to its policy to allow immediate removals to clean up more hazardous wastes from priority sites. While agreeing with this proposal, GAO believes that the policy revision should also require that immediate removal actions eliminate surface hazardous substances to the extent that such actions reduce recurring threats, avoid repeated actions, minimize Superfund expenditures, and contribute to the permanent remedy of hazardous sites.

TYPES OF REMOVAL ACTIONS TAKEN

Immediate removal actions at 165 hazardous waste sites included installing fences around sites to prevent access, removing drums and tanks, draining lagoons and ponds, treating liquids and sludge, placing drums in larger containers and storing them elsewhere on the site, covering contaminated soil with clay caps, building dikes around hazardous waste lagoons and tanks to prevent runoff, and various other activities addressing immediate and significant threats. In many cases, immediate removal actions included a combination of the above activities. EPA estimates that spending averaged about \$302,000 per action, ranging from about \$1,000 to \$3.4 million. (See pp. 8 and 9.)

ACCOMPLISHMENTS AND CONTRIBUTIONS TO LONG-TERM CLEANUP GOALS

From EPA records GAO identified 165 hazardous sites with immediate removal actions. Of these, 72 were priority sites. This report focuses on cleanup efforts at priority sites because EPA has responsibility for a permanent remedy at these sites. At non-priority sites EPA has responsibility for stabilizing or cleaning up immediate and significant threats. Any additional cleanup is the responsibility of the state or responsible party.

Of the 72 priority sites, 19 had subsurface contamination such as contaminated soil and

groundwater. These will require in-depth study before remedial action can begin. The remaining 53 priority sites had hazardous substances on the surface as well as possible subsurface contamination before removal actions began.

After immediate removals some or all of the surface hazardous sources remained on-site at 38 of the 53 locations. The other 15 sites will require some remedial action to address subsurface problems. (See pp. 9 and 10.)

HAZARDOUS SUBSTANCES LEFT
ON-SITE THREATEN THE PUBLIC
AND ENVIRONMENT AND INCREASE
CLEANUP COSTS

Of the 38 priority sites where hazardous substances remained after the first immediate removal action, 20 required additional actions to address recurring actual or threatened releases of hazardous substances. These 20 sites required 1 to 4 recurring actions per site, for a total of 34 actions. These 34 additional actions addressed hazards posed by lagoons, drums, tanks, and soil contamination. The other 18 priority sites have not posed severe enough threats to warrant repeated actions. As long as the hazards remain on-site, however, conditions could worsen, requiring more immediate removals before a permanent remedy can occur, a process that could take several years to plan and implement. (See pp. 11 and 12.)

For example, at one removal site EPA partially drained four lagoons filled with hazardous substances and cleaned the contamination from the surrounding areas after the lagoons overflowed. For the next two years rain refilled the lagoons and EPA had to partially drain them four more times to prevent overflows. More than \$567,000 has been spent for all five removal actions. A permanent remedy is currently under study. (See p. 12 and 13.)

Removing surface hazardous substances from priority sites during immediate removals would reduce threats to the public and environment and avoid the costs incurred from repeated actions. Although GAO could not quantify specific costs, the costs to clean up the spread of contamination, mobilize equipment,

and develop plans for each action suggest that savings are possible. (See. pp. 13 to 15.)

SUPERFUND PLANS TO ALLOW MORE
COMPLETE CLEANUP WITH REMOVAL ACTIONS

Superfund legislation requires that removal actions be limited to \$1 million and last no more than 6 months, although EPA can exceed these limits on an exception basis. Using authority allowed in the Superfund legislation, EPA chose to further limit the scope of removal actions to preventing or mitigating immediate and significant risks of harm to the public and environment. EPA chose this course to assure that Superfund dollars would be available for the most pressing hazardous waste problems posed by priority sites. EPA's choice may have been appropriate for this new program; on the basis of experience, however, this policy has limited EPA's ability to achieve more complete cleanup at priority sites. (See pp. 8 and 9.)

EPA recognizes the limiting impact of its existing policy and, in September 1984, proposed regulation revisions that would allow more of its superfund resources to be used by its immediate removal actions to provide more complete cleanup of hazardous substances at priority sites. While EPA has not yet implemented this proposal, GAO believes it will potentially allow more complete cleanup of surface hazards, which are more conducive to short-term cleanup than are subsurface hazards. However, the proposed revisions do not establish what the immediate removal actions are supposed to accomplish. This may result in the same kind of costly temporary, partial surface cleanup actions found under current policy.

GAO believes that EPA's immediate removal actions should be required to attain more surface cleanup when performed at priority sites. This would eliminate the health hazard earlier. It should also save money now often spent on repeated temporary actions. GAO's suggested addition to EPA's proposed policy revision, coupled with the current legislative requirement that any

removal actions costing more than \$1 million and lasting more than 6 months be subject to more intensive EPA review, should help ensure that EPA removal actions promote permanent cleanup of surface wastes and also husband Superfund resources for the most pressing hazardous waste sites. (See pp. 15 and 16.)

RECOMMENDATION TO THE
ADMINISTRATOR, EPA

GAO recommends that the Administrator, EPA, include in EPA's revisions to its regulations a requirement that removal actions eliminate surface hazardous substances to the extent possible to reduce recurring threats, avoid repeated actions, minimize Superfund expenditures, and contribute to the permanent remedy of priority hazardous waste sites.

AGENCY COMMENTS

GAO did not request EPA's comments on this report. GAO did, however, discuss its contents with EPA headquarters and regional officials responsible for the Superfund program and incorporated their views where appropriate.

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ABBREVIATIONS

EPA	Environmental Protection Agency
GAO	General Accounting Office
NCP	National Contingency Plan
NPL	National Priorities List

CHAPTER 1

INTRODUCTION

Addressing the problems related to the handling of hazardous substances has become a national concern. Hazardous substances can seep into groundwater supplies, contaminate land, and escape into the air, thereby posing real or potential threats of damage to human health and to the environment. In 1983, industries in the United States generated an estimated 281 million to 303 million tons of hazardous wastes--almost double the 1981 level. The chemical and allied industries are the largest but certainly not the only generators of hazardous substances nationwide. These substances are not always properly handled and disposed of: each year many hazardous waste spills occur, uncontrolled and illegal disposal of waste material is found, and abandoned waste dumps are discovered.

Hazardous substances are found in many forms: solids, liquids, sludge, and gaseous materials. They may be toxic, ignitable, corrosive, infectious, radioactive, or may cause a hazardous reaction, and may be found almost anywhere. The Environmental Protection Agency (EPA) estimates that there are 18,000 sites across the country where hazardous substances can be found. These include abandoned facilities, midnight dumps, transportation-related spills, and operating fixed facilities. Hazardous waste sites and abandoned facilities are sites used to dispose of hazardous substances; they include landfills, quarries, incineration plants, and abandoned manufacturing operations using hazardous materials that were not properly cleaned up. Midnight dumps are roadsides, vacant lots, or wilderness areas where hazardous substances were illegally disposed of or stored. Transportation-related spills result when accidents occur while moving hazardous substances. Operating fixed facilities are ongoing businesses that use hazardous materials. At these sites, hazardous substances are found in drums, tanks, or other containers; in lagoons or pits; scattered or poured on the ground; or buried or seeped underground.

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly known as the Superfund, was enacted on December 11, 1980, to provide for cleanup¹ of the nation's hazardous waste sites. The Superfund authorizes the President to respond whenever any hazardous substance, pollutant, or contaminant is released² or threatens release into the

¹Neither the act nor EPA's implementing regulations define cleanup. As used in this report, cleanup refers to eliminating or reducing the hazards at waste sites.

²According to the act, release means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment.

environment. The President delegated this authority to EPA by Executive Order 12316, August 17, 1981. The act provides for a \$1.6 billion fund to be accumulated over a 5-year period from taxes on petroleum and certain chemicals and from federal appropriations.³ EPA uses the Superfund to clean up spilled toxic wastes and hazardous waste sites and takes enforcement actions to recover from responsible parties the funds it expends during site cleanup. Superfund's taking authority expires at the end of fiscal year 1985. Because of the increased awareness over the size of the cleanup problem, the Congress is considering substantial increases to the size of the fund. The Superfund cleanup program is administered by EPA's Office of Emergency and Remedial Response.

SUPERFUND PROVISIONS

The act defines two types of responses to hazardous substance releases or threatened releases: removal and remedial. Section 101 defines removal actions as the cleanup or removal of released hazardous substances from the environment; action needed when a release is threatened; action needed to monitor, assess, and evaluate actual or threatened releases; the disposal of removed material; or the taking of other such actions necessary to prevent, minimize, or mitigate damage to the public health, welfare, or the environment. Remedial actions are defined as those designed to prevent or minimize the release of hazardous substances so that they do not migrate to endanger present or future public health, welfare, or the environment. Remedial actions are those leading toward a permanent remedy taken instead of, or in addition to, removal actions upon release or threatened release of hazardous substances into the environment.

Section 104 of the act provides the general authority under which EPA may take removal and remedial actions and provides limitations on EPA's exercise of that authority. For example, removal obligations from the fund generally shall not continue after \$1 million has been obligated or 6 months has elapsed from the date of the initial response. The law provides, however, that EPA can exceed these limitations on an exception basis. Remedial actions shall not begin unless the affected state first enters into a contract or cooperative agreement providing certain assurances regarding cost share, future maintenance, and availability of disposal facilities. Section 104 does not designate the type of action that EPA should undertake in response to specific releases or threatened releases of hazardous substances. Rather, it leaves those determinations to EPA.

³Most of the Superfund, about 87%, comes from the earmarked tax receipts on petroleum and certain other chemicals. As of December 1984, EPA received \$1.55 billion in appropriations and reported obligations of \$916 million and disbursements of \$521 million.

Section 105 required that EPA revise the National Contingency Plan (NCP) to incorporate Superfund's responsibilities and authorities, including methods and criteria for determining the appropriate extent of removal actions. This plan, first published in 1968 under the Federal Water Pollution Control Act, initially outlined procedures for oil-spill cleanups. In 1982, under the authority delegated to EPA by the President, the NCP was revised to delineate federal and state response authorities for abandoned or uncontrolled hazardous waste sites.

SUPERFUND CLEANUP PROCESS

EPA's revised NCP provided for three types of Superfund actions for incidents involving hazardous waste sites:

- Immediate removal actions are to provide prompt response (within hours or days) to prevent immediate and significant harm to human life, health, or the environment. Examples include averting fires or explosions, installing fences or other barriers to limit access, or moving hazardous substances off-site. Generally, immediate removals are limited to those that can be completed within 6 months and cost no more than \$1 million.
- Planned removal actions are those that allow time to plan the cleanup activities but that still require expedited action to reduce an imminent and substantial danger. The 6-month or \$1 million general limitation also applies, and states are required to contribute 10 percent of the removal costs. Both immediate and planned removal actions can be taken anywhere that a hazardous waste threat exists.
- Remedial actions are intended to achieve a permanent and cost-effective remedy or cleanup of hazardous waste sites. Remedial alternatives can mean no action, containment of wastes on-site, a mix of cleanup and containment, or total site cleanup. The NCP also requires that the cost of the remedy be balanced against the amount of money in the fund needed to respond to other hazardous waste problems. Remedial actions usually require extensive studies along with state funding contributions. Because of the complexities of these studies, it may take from 2 to 3 years before remedial actions begin. In some instances, initial remedial measures can and should begin before selecting a permanent remedy to limit exposure or threat of exposure to a significant health or environmental hazard. The conditions used in determining the appropriateness of initial remedial measures are those used for planned removal actions but without the time and cost limitations.

Wherever an immediate and significant risk to the public health or environment exists, removal actions can be used to prevent or mitigate that threat. For the purposes of this report,

our use of the terms removals and removal actions will refer to immediate removal actions.

To be eligible for a remedial action under the Superfund, a site must be included on EPA's National Priorities List (NPL). This list designates the nation's worst known sites contaminated with hazardous substances posing the greatest threat to humans or the environment. NPL sites are determined by a national ranking system,⁴ and each state is allowed to designate a state priority site regardless of its national ranking. As of October 1984, NPL included 538 sites, with an additional 248 sites proposed.

At any time during removal or remedial actions, EPA can require, to the extent possible, that responsible parties⁵ either perform the cleanup themselves or reimburse EPA and the states for incurred costs.

USING REMOVAL AND REMEDIAL ACTIONS TO ADDRESS HAZARDS

EPA has identified nearly 18,000 locations where hazardous substances are suspected. Recent EPA estimates indicate that 4,000 additional sites may eventually be discovered. With EPA's latest proposed additions to the NPL, the priority list could expand to 786 sites, and EPA estimates it could eventually grow to as many as 1,800 sites. As defined by the NCP, EPA may undertake removal actions at any of the 18,000 sites (including these on the NPL) to abate or prevent immediate and significant threats but may undertake remedial actions to provide a permanent remedy only at the 786 proposed and final NPL sites.

Under EPA's hazardous waste site assessment process, known sites undergo a preliminary assessment that generally entails a cursory review of information about wastes at a given site. Assessed sites with waste problems preliminarily deemed serious enough undergo a site inspection, which includes an on-site visit, sampling, and analysis of waste problems. Once a site is inspected, the seriousness of any waste problem is evaluated to determine if the site should be placed on the NPL. The distinction between NPL sites and non-NPL sites determines whether the site is scheduled for long-term cleanup. Sites on the NPL are candidates for permanent remedy. Remedial planning and implementation under the NCP generally involves the following

⁴The hazard ranking system is designed to estimate the potential hazard presented by releases or threatened releases of hazardous substances, pollutants, and contaminants.

⁵A person, corporation, or other entity that is (1) a past or present owner or operator of a site and/or (2) a generator or transporter who contributed hazardous substances to a site.

- Preparation of an initial plan for the collection of information needed to develop a site strategy.
- Investigation to determine the type and extent of contamination at the site.
- Preparation of a feasibility study to analyze various cleanup alternatives and assess their cost-effectiveness. The feasibility study is often conducted with the investigation as one project.
- Selection of the most "cost-effective" remedy--that is, the alternative that effectively mitigates or minimizes the hazard and still provides adequate protection to human health and the environment at the least cost.
- Design of the remedy.
- Implementation of the remedy, which might involve, for example, constructing facilities to treat groundwater.

At any point in the process, removal action may be initiated if circumstances warrant.

If removal action is necessary at a non-NPL site, federal involvement ends when the removal action abates the threat. No other federal action is planned at a non-NPL site unless (1) immediate and significant threats recur that necessitate another removal, (2) threats persist that require a planned removal, or (3) the site is added to the NPL for permanent remedial action. The same criteria of preventing or mitigating immediate and significant threats applies to removal actions initiated and performed at NPL sites. Unlike non-NPL sites, however, federal involvement continues at NPL sites through (1) initial remedial measures if serious threats occur, and/or (2) remedial action consistent with a permanent remedy.

OBJECTIVES, SCOPE, AND METHODOLOGY

In a July 5, 1984, letter, the Chairman, Subcommittee on Commerce, Transportation, and Tourism, House Committee on Energy and Commerce, expressed concern that EPA's removal actions may constitute only temporary solutions to hazardous waste site problems and that the removal actions may not be coordinated with long-term site cleanup goals. The Chairman requested that we determine (1) what types of removal actions are taken at hazardous waste sites, what these actions accomplish, and how they contribute to long-term cleanup goals, and (2) if existing legislation allows for a more comprehensive cleanup of surface hazardous substances by the removal program.

To determine the number of sites where removal actions were taken we reviewed EPA removal program summary reports and identified 165 sites where EPA finished immediate removals between

December 11, 1980 (the date Superfund was enacted) and February 1, 1984 (the date our site identification work was completed). Even though EPA has finished additional immediate removal actions since we completed our field work, our message remains valid because EPA has not yet revised its NCP guidance. Although not part of our review, there were an additional 25 Coast Guard removal actions and 9 EPA-planned removals completed during the same period. We reviewed initial remedial measures performed at NPL sites where removal actions were previously completed because of their similarity to removal actions.

We did not review immediate removal actions that were under-way because their completeness cannot be assessed until the action is finished.

We performed work at EPA headquarters in Washington, D.C.; region III (Philadelphia, Pennsylvania); region V (Chicago, Illinois); and region IX (San Francisco, California). These regions were selected because they were among the top EPA regions in numbers of removal actions completed. Of the 165 finished actions, 80 (48.5 percent) were in these three regions. We also contacted officials at the Pennsylvania Department of Environmental Resources, Illinois Environmental Protection Agency, and California Department of Health Services to discuss their roles in the Superfund removal program.

To determine the types of immediate removal actions taken at hazardous waste sites, their accomplishments, and how they contributed to site cleanup, we examined case files at EPA regions III, V, and IX. At EPA headquarters we examined immediate removal case files for the remaining EPA regions. We also interviewed removal and remedial officials at EPA regions III, V, IX, and at EPA headquarters to determine the criteria available for carrying out removal actions.

To determine whether existing legislation allows for more comprehensive cleanup by the removal program, we reviewed the federal response powers and authorities granted EPA in Superfund legislation and the policies and procedures incorporated in the NCP.

As requested by the Chairman's office, we did not obtain agency comments on the report. We did, however, discuss the matters contained in the report with EPA headquarters and regional officials responsible for the Superfund program. Their views have been incorporated in the report where appropriate.

Our work was conducted from September 1983 through April 1984. Our review was performed in accordance with generally accepted government auditing standards.

CHAPTER 2

REMOVAL POLICIES SHOULD BE REVISED TO ENHANCE CLEANUP AT THE MOST HAZARDOUS SITES

EPA's removal policies and procedures, as established in the NCP, inhibit its ability to use the removal program as an aid in the permanent, long-term cleanup of NPL hazardous waste sites. Using the authority provided in the act, EPA chose, in implementing the Superfund program, to limit removal actions to preventing or mitigating immediate and significant risks of harm to human health, welfare, or the environment, so that removal actions would not use an inordinate share of the Superfund budget on less significant, non-NPL sites. The determination of immediate and significant risk is a subjective matter because NPL sites are eventually scheduled for long-term remedial action. Therefore, removal actions at NPL sites were usually of a short-term or stopgap nature, stabilizing hazardous waste threats until the remedial program could provide permanent, long-term cleanup solutions. Consequently, most NPL site removal actions did not remove hazardous substances located on the site's surface. But hazardous substances left on-site after removals have resulted in recurring releases of wastes and continued threats to the public and environment, often necessitating repeated, costly cleanup actions.

EPA's September 10, 1984, draft of its proposed revisions to the NCP would modify removal criteria. However, it would not necessarily assure that removals would reduce recurring threats, avoid repeated actions, or minimize Superfund costs. We believe that EPA needs to establish a cleanup requirement for removal actions at NPL hazardous waste sites to ensure the most effective use of Superfund resources.

EPA POLICIES AND PROCEDURES LIMIT THE EXTENT OF REMOVAL ACTION

According to the NCP, removal action is appropriate at a hazardous waste site if the action will prevent or mitigate an immediate or significant risk of harm to the public or the environment. Threatening situations can arise from direct contact with acutely toxic substances, contaminated drinking water, and fire or explosion. The removal action is complete when the immediate or significant risk no longer exists and any hazardous substances transported off-site have been treated or disposed of properly. The extent of the removal action, then, is limited to abatement of the immediate and significant risk that precipitated the action.

EPA, when it published the NCP, recognized that the limits placed on removal actions may prevent EPA from fully abating the threat caused by a release of hazardous wastes. According to the plan, without such limitations, an inordinate share of the Superfund might be spent on completing removal actions at sites that

pose less significant threats than sites on the NPL. Moreover, if removal actions were not limited in scope, they might continue until reaching the limits of 6 months or \$1 million without having achieved any tangible or specified cleanup objectives. Using this rationale, EPA limited the scope of removal actions in the NCP.

The limiting criteria may be appropriate for removal actions at non-NPL sites where, by their very nature of not being placed on the NPL, the hazardous waste threats are not as severe as those on the NPL. Although EPA is responsible for the overall cleanup of NPL hazardous waste sites as well, the NCP removal restrictions, as implemented, limit the extent to which EPA can use removal actions to aid in the cleanup of these higher priority sites.

The NCP removal criteria also did not establish a cleanup goal for determining the extent of cleanup that removal actions should strive to attain at hazardous waste sites. Although abatement of the immediate and significant risk is used to specify the completion of a removal action, the range of actions used to achieve that end varies widely. Thus, application of the restrictive and subjective removal criteria can and does result in substantial variation in the degree of hazardous waste cleanup.

REMOVAL ACTIONS HAVE PROVIDED DIFFERING DEGREES OF CLEANUP

EPA removal actions have varied--from those that completely removed hazardous substances from sites to those that only fenced the sites in, letting contamination sources remain on-site. Our review found that EPA cleaned up hazardous substances at sites not on the NPL, while removal actions at NPL sites left contamination sources on the surface. At the NPL sites, the hazardous substances were contained or temporarily stabilized without the source of contamination being removed. In each case, the immediate danger was removed and the hazardous waste contained or temporarily stabilized in anticipation of the future, long-term remedial action. In contrast, removal actions at non-NPL sites tended to remove hazards from the site, since non-NPL sites usually receive no further federal action. (See p. 5.)

Types of removal actions

Our review of EPA removal actions completed between December 1980 and February 1984 at 165 sites showed that 72 were listed on the NPL, while 93 were not. Estimated costs for completing removal actions at these 165 sites averaged about \$302,000, with individual estimates ranging from \$1,000 to \$3.4 million. Actual removal cleanup time ranged from 1 day to over 1 year. Extensions beyond the 6-month and \$1-million removal limitations were allowed when immediate threats persisted and other assistance could not be provided on a timely basis. Hazardous waste sites/abandoned facilities accounted for 92 percent of the NPL and 60 percent of the non-NPL sites where removal actions were completed.

The types of removal actions performed at these sites involved several different response activities. Removal actions consisted of installing fences around the sites to prevent access; removing drums, barrels, or tanks; draining ponds and lagoons; treating contaminated liquids and sludge; and containing or stabilizing the hazardous substances on-site to temporarily prevent future releases. A common action was to partially drain lagoons or raise lagoon walls to prevent overflow. Other contamination sources were capped with a layer of clay to prevent rainfall from carrying hazardous wastes off-site or into groundwater. Drums were placed in larger containers called overpacks and/or secured in holding areas on specially prepared pads. Tanks were surrounded by dikes to capture leaked materials. Runoff controls were installed to prevent rainwater from washing contamination off-site or exposing buried wastes.

Most removal actions used a combination of these response activities. In each removal action, EPA considered the techniques used to have abated or mitigated the immediate and significant threats that precipitated the removal.

Accomplishments and contributions to long-term cleanup goals

At NPL hazardous waste sites, removal actions let hazardous substances remain, although the hazards were contained or temporarily stabilized on-site in anticipation of future, long-term remedial cleanup. In contrast, removal actions at most non-NPL sites removed most hazards from the site since non-NPL sites receive no further Superfund actions unless immediate and significant threats recur or the site is eventually placed on the NPL.

The following table shows the number of sites where EPA's removal actions have cleaned up all hazardous substances, and those where hazards have been left on-site and will require further cleanup to prevent threats to humans and the environment.

<u>Type of site</u>	<u>No additional cleanup required</u>	<u>Additional cleanup required</u>
NPL	0	72
Non-NPL	<u>67</u>	<u>26</u>
Total	<u>67</u> =	<u>98</u> =

Of the 165 sites reviewed, additional cleanup is required at 59 percent. Of those needing additional attention, 73 percent are on the NPL--the most dangerous sites. All 72 of the NPL sites require more cleanup, whereas only 26 of the 93 non-NPL sites do. While removal actions taken at NPL sites appear to be only those that are time-critical, the longer term threat of these sites is not addressed with removal action as fully as are the sites not on

the priority list. Removal actions at NPL sites were not as complete as at non-NPL sites because of EPA's policy that its remedial program would provide the site's permanent solution.

Although EPA's responsibility under the NCP for cleanup at non-NPL sites ends with completion of the removal action, a "responsible party" or state can perform additional site cleanup. We made no further analysis of non-NPL sites to determine subsequent action, if any. The remainder of this report is devoted to NPL sites where EPA has the responsibility for assuring a permanent--as well as timely--remedy to the sites' hazardous waste threats.

At the 72 NPL sites where EPA performed removal actions, we identified the type of hazards present before and after EPA's action. Surface and possible subsurface hazardous substances were present at 53 sites before EPA acted; 19 sites had subsurface contamination only, such as contaminated soil and groundwater. EPA considers these subsurface problems more difficult to solve and requiring considerable analysis before action can be taken. Subsurface contamination generally falls under the responsibility of the remedial program.

Of these 53 NPL sites, 38 were found to retain some or all of the surface hazardous substances even after removal action. The remaining 15 sites, where removals eliminated the surface hazardous substances, will still require remedial cleanup action to address their subsurface problems. The following table shows the types of surface contamination sources and the number of sites where they were present before and after removals. The number of sites does not total 53 and 38, respectively, because of the presence of multiple surface contamination sources at some sites.

<u>Surface contamination</u>	<u>Number of NPL sites with surface contamination</u>	
	<u>Before removal</u>	<u>After removal</u>
Drums/containers	29	16
Lagoons/pits	29	24
Tanks	22	17
Soil and hazardous substances largely at or near the surface	27	15

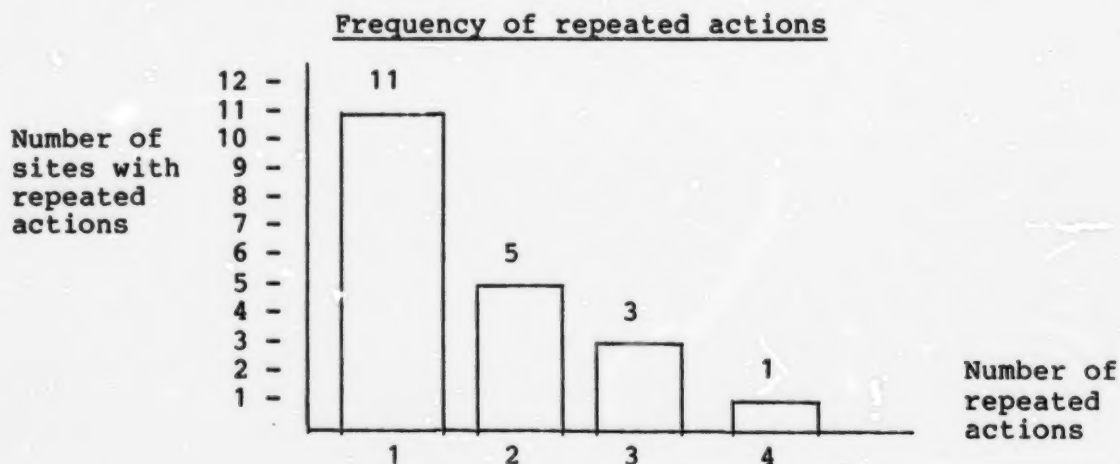
Hazardous substances are left on-site when removal actions (1) contain or stabilize the hazards at the site until some later action is taken, or (2) do not address hazards at all. EPA considers the hazardous substances contained or stabilized when the threats to the public and environment have been sufficiently abated or mitigated until EPA's remedial program can provide long-term cleanup solutions. Some hazards are not addressed because they do not pose the immediate and significant threats that caused the removal.

HAZARDOUS SUBSTANCES LEFT ON-SITE
THREATEN THE PUBLIC AND THE ENVIRONMENT
AND INCREASE CLEANUP COSTS

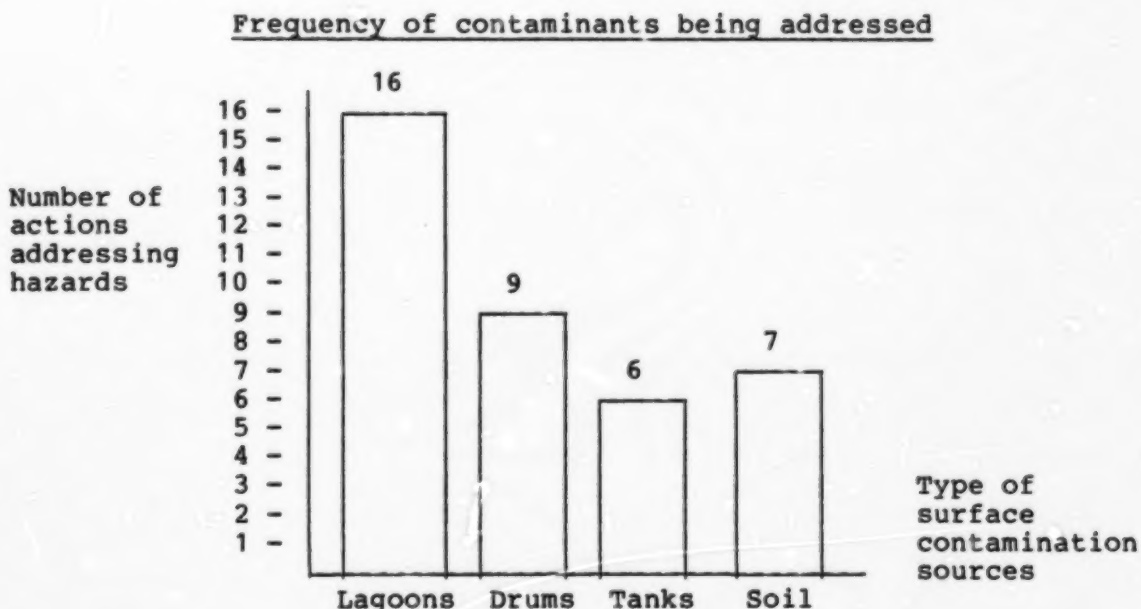
Repeated costly actions could be avoided through more complete removal actions. Repeated actions include additional removals to abate recurring threats and initial remedial measures necessary to limit exposure to serious threats before final selection of an appropriate remedial action. Repeated actions incur avoidable costs resulting from the use of temporary containment or stabilization measures, the further spread of contamination, and the need for repeated mobilization and demobilization for each action.

Of the 38 NPL sites where surface hazardous substances were left on-site following a removal action, 20 sites required 34 subsequent actions because of an actual or threatened release of hazardous substances. The other 18 sites with contamination remaining on the surface did not pose severe enough threats to warrant repeated attention and were awaiting permanent remedial action. As long as hazardous substances remain on-site, however, a threat exists that conditions may worsen--requiring another action before completion of a final remedy.

Each of the 34 repeated actions at the 20 sites was performed in response to immediate and significant risks of harm to human life, health, or the environment (removal actions), or to limit exposure or threat of exposure to a significant health or environmental hazard (initial remedial measures) after the completion of a first removal action. The 34 repeated actions ranged from a single repeated response at 11 sites to anywhere from 2 to 4 subsequent responses at the other 9 sites. The following chart displays the frequency of repeated actions at the 20 sites.



The 34 repeated responses addressed a variety of surface contamination sources. The following chart shows the types of contaminants most frequently handled by actions following the first removal at the 20 NPL sites.¹



A number of repeated actions involved NPL sites with lagoons containing hazardous substances. A removal action at a lagoon typically stabilizes the hazard by increasing the space between the lagoon liquid and the top of the lagoon. This gap is increased by pumping out the lagoon's contents to lower the level of the liquid or by increasing the height of the dikes or walls surrounding the lagoon. Rains can refill the lagoon within a relatively short time, however, releasing or threatening to release the lagoon's contents to again expose the public and environment to additional risks. Complete draining of the lagoons during the first removal action at the sites could reduce the threats and avoid costly repeated actions. At one site in Greenup, Illinois, EPA has performed five removal actions to stabilize lagoons.

A and F Materials is a defunct oil and chemical waste storage and treatment facility. The site included four unlined lagoons containing oil, industrial waste, and rainwater contaminated by PCBs and other hazardous substances. In addition, 13 tanks of hazardous substances were on-site. Discharges from the site enter the Embarras River, a major waterway heavily used for fishing and for watering livestock. Public drinking water is drawn 40 miles downstream from the site. Fishers, hunters, and children use the flood

¹The types of contaminants total 38, not 34, because some actions responded to more than one contaminant.

plain around the river for recreation. Residences are within 30 yards of the site. Federal action at the site began in 1980, when \$240,000 in Clean Water Act² funds were spent to repair the lagoon dikes, partially drain the lagoons, and clean contamination from the surrounding area resulting from lagoon overflows. In 1982, to prevent a threatened overflow, EPA began a Superfund removal at the site by partially draining the lagoons at a cost of \$62,000. Rain caused lagoon levels to rise and forced another EPA removal later in 1982, when the lagoons were again partially drained at a cost of \$42,000. In the spring of 1983, the lagoons threatened to overflow once more. EPA fully drained three of the lagoons and transferred most of the sludge to the remaining lagoon. The drained lagoons were graded over; the remaining lagoon was temporarily covered. This action alone cost \$195,000. EPA experienced difficulties, however, in keeping the lagoon cover in place; two site visits costing approximately \$13,000 were necessary to maintain the cover. Recent EPA information disclosed that another removal action was performed in April 1984 to stabilize the lagoon at an estimated cost of \$15,000. In total, these federal actions cost about \$567,000. A permanent remedy is currently under study.

Other repeated actions involved NPL sites with various combinations of drums, tanks, and hazardous substances in surface water, groundwater, and strewn about the soil. The first removal action abated or prevented an immediate and significant threat. However, the hazards left on-site awaiting permanent remedial action caused serious enough threats to the public health and environment to require an early action under the remedial program, called an initial remedial measure. EPA began such an action after completion of a removal at the Aidex Corporation.

The Aidex Corporation, Council Bluffs, Iowa, was a pesticide-producing facility that was abandoned in 1981 after a fire. Pesticides contaminated surface water, groundwater, and topsoil, and were blown off-site. The site had 4,000 drums stored or buried and a large underground storage tank. Because of the hazardous substances on-site and a lack of security to prevent access, EPA performed a removal action to fence the site off in December 1981. In September 1982 EPA recommended early remedial action to abate deteriorating site conditions, further limit public exposure, and prevent wastes from migrating off-site while remedial program investigation and studies were underway. In August 1983 EPA completed the first phase of an initial remedial measure, which included on-site collection and packaging of pesticides, contaminated solids, liquids, and sludge. These hazards were eventually

²Before the Superfund's enactment, EPA used authorities and funds available under the Clean Water Act to address hazardous waste problems that affected surface waters.

removed during the second phase of the action, completed in April 1984.

Since hazardous substances were eventually removed from the surface prior to any permanent site remedy, a more complete first removal action might have reduced the threats to the public and environment and alleviated the deteriorating site conditions necessitating early remedial measures.

Removing hazardous substances from a site during first removal actions would not only reduce threats to the public and environment, but would also avoid additional costs incurred from repeated actions. Although we were unable to quantify EPA's costs for specific response activities performed during repeated actions in order to determine potential savings from more thorough first removal actions, we believe that the avoidance of costs necessary to clean up the spread of contamination from recurring releases and the costs of repeated mobilization and demobilization (see below) suggest that savings are possible.

However, because some first-time removal actions only temporarily contain or stabilize hazardous substances on-site, releases recur--increasing soil, surface water, and groundwater contamination. When hazardous substances are released, subsequent actions are not only required to stop the release but also to clean up any areas contaminated by the release to prevent further threats. The additional cleanup results in higher-cost actions.

In addition, mobilization and demobilization costs are incurred for every action at a site. Mobilization costs include bringing office and laboratory trailers on-site and connecting electricity, phone lines, and other utilities. Equipment must also be brought on-site, such as heavy equipment for drum removal and pumping equipment for draining lagoons. A site safety protocol must be established and personnel and equipment decontamination zones must be set up. In addition, a community relations plan must be developed to outline the nature of community concern, the key site issues, and activities to be undertaken at the site. During demobilization, equipment must be decontaminated and removed and any property restored as necessary. According to the region III emergency response section chief, mobilization and demobilization costs can represent a significant portion of a removal action's costs. For a typical \$100,000 removal action, such costs currently range from \$20,000 to \$30,000. For larger actions, these costs increase, although they do not then make up as large a percentage of total costs.

Our review of the 20 NPL sites with repeated actions following removals showed first-time estimated removal costs totalling \$6,542,000, with estimates for subsequent actions costing \$21,149,000. Repeated removal actions were estimated to cost \$9,931,000, while initial remedial measures were estimated to cost \$11,218,000. Of course, many of these repeated actions eventually

included surface hazardous substance cleanup at the 20 NPL sites. These costs would then be incurred during any first, more complete removal action. Although savings would have been likely had more complete removal been done during the first effort, we were not able to estimate the potential amount.

CONSIDERING OVERALL SITE CLEANUP AND
RELATED COSTS CAN HELP ELIMINATE
SURFACE HAZARDOUS SUBSTANCES

As part of our review, we analyzed available remedial program feasibility studies of NPL sites where removal actions left surface contamination sources on-site. These studies show that considering overall site cleanup and related costs at the beginning can result in actions that eliminate surface hazardous substances rather than leave them on-site to create further problems. The types of hazards involved are the same as those facing the removal program. The actions chosen--disposal of drums and lagoon contents--fall within the scope of the removal program and have been carried out by removal personnel many times.

At one site, Envirochem in Zionsville, Indiana, a study concluded that a pond should be fully drained rather than temporarily contained through a dike, liner, and insoluble wall. The study also rejected storing drums on-site in favor of off-site disposal. Disadvantages of leaving the drums on-site included the space taken up by the drums, the costs of preparing the storage area and moving the drums to it, and possible deterioration of the drums during storage. The study concluded that because the drums will have to be removed during remedial activities anyway, on-site storage would greatly increase the total cost of site cleanup. Although the study proposed these activities under the remedial program, EPA completed a removal action estimated to cost \$3.2 million. The action was done as a removal because of the significance of the threat and the onset of winter weather.

The chiefs of the EPA region III, V, and IX Superfund remedial groups said that the surface hazardous substances are generally removed as the first phase of remedial action at NPL sites.

EPA ATTEMPTS TO
REVISE THE NCP

EPA's draft revisions³ to the NCP, dated September 10, 1984, recognize that the original NCP imposes limiting restrictions on the removal program beyond those mandated in the act. The

³The proposed revisions are scheduled to be published in the Federal Register in early 1985, at which time interested parties will be allowed to comment.

proposal states that based on EPA's experience it "believes the existing removal provisions tend to complicate and interfere with expeditious responses to situations which present threats to public health or the environment, and do not provide significant fund-management benefits." Because of these concerns, EPA is proposing to eliminate the "immediate and significant risk" criterion for immediate removals. According to the chief of the removal program's response operation team, eliminating "immediate and significant threats" criteria will allow EPA to take more complete removal actions.

A major difference between removal as used in the NCP and the definition in the act is the NCP addition of the terms immediate and significant risk. In the act, removals can deal with the release or substantial threat of release of any hazardous substance into the environment. The NCP, however, limits removal actions to releases or threatened releases that are sudden and can quickly cause substantial human and environmental damage. Contamination sources not presenting such problems at a given time, or those producing slow releases over a period of time, may be excluded from a removal action. Yet the term hazardous substances in itself implies a certain urgency and importance. Its definition includes waste that may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed. Thus use of the terms immediate and significant risk is subjective and can be properly applied to almost any hazardous waste site, and limiting removal actions to abating the immediate and significant threats can result in some hazards being left untouched, only to pose serious threats later while awaiting future remedial action.

Conversely, while we agree that the proposed NCP revisions will allow EPA to accomplish more with its removal actions, the proposal to eliminate the "immediate and significant risk" standard without providing alternative objectives on what removal actions should achieve could result in a similar situation of temporary, partial cleanup; recurring threats; and costly repeated actions. As discussed earlier, surface hazards, as opposed to subsurface hazards, are often conducive to short-term removal actions. The former acting director of the removal program agreed that if the removal program were directed to dispose of, rather than just contain, surface hazardous waste, sites would be cleaned up more quickly and future costs avoided. However, the staff person in the Superfund policy office responsible for revising the NCP told us that the statutory limitations of \$1 million and 6 months may prevent some removal actions from providing more surface cleanup. He stated that exemptions from these limitations can be obtained but that the perception is that the limitations serve a useful purpose by defining the program's intended scope. EPA is currently studying the impact of these limitations and whether there is a need to request a legislative change.

CONCLUSIONS

In implementing the Superfund program, EPA chose to limit removal actions to preventing or mitigating immediate and significant risk of harm to human health, welfare, or the environment. EPA did this so that removal actions would not use an inordinate share of the Superfund budget on less significant, non-NPL sites. EPA's choice may have been appropriate when EPA was still defining the scope of the new program; EPA recognizes, on the basis of experience, however, that the policy has prevented the agency from using the removal program to provide more complete surface cleanup at NPL sites. Non-NPL sites have generally (about 70 percent of the time) received complete surface cleanup since EPA policy for the non-priority sites is that no additional actions beyond the initial one can be undertaken unless immediate and significant threats recur or the site is placed on the NPL.

Most EPA removal actions at NPL sites stabilized hazardous substances on-site for eventual cleanup under the remedial program. Contaminants left on-site after removal actions, however, continue to threaten the public health and the environment, resulting in inefficient and costly repeated actions.

In recognizing the limiting impact of its existing policy, EPA proposed revisions that would allow Superfund resources to be used on immediate removal actions in order to provide more complete cleanup of hazardous substances at NPL sites.

Although EPA's proposed NCP will eliminate the restrictive criteria placed on removal actions, the revised policy does not provide an objective that removal actions should achieve at NPL sites. Without this objective, removal actions could result in temporary, partial surface removals similar to those found under the current NCP. We believe that EPA could better assure reduced threats to the public health and the environment at less Superfund cost by requiring a removal action to attain more thorough surface cleanup at NPL sites. Establishing explicit objectives for surface waste cleanup before permanent cleanup is started, coupled with the current legislative requirement that removal actions costing more than \$1 million and lasting more than 6 months be subject to intensive EPA review, should help ensure that removal actions at priority sites accomplish permanent cleanup and ensure that Superfund resources are available for the most pressing hazardous waste problems.

RECOMMENDATION TO THE ADMINISTRATOR, EPA

To better ensure that Superfund resources are effectively used, we recommend that the Administrator, EPA, include in the revisions to the NCP a requirement that removal actions eliminate surface hazardous substances to the extent possible to reduce recurring threats, avoid repeated actions, minimize Superfund expenditures, and contribute to the permanent remedy of NPL hazardous waste sites.